

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE UNIVERSITY OF NEBRASKA, NEBRASKA SOIL
SURVEY, G. E. CONDRA, DIRECTOR.

SOIL SURVEY OF KIMBALL COUNTY,
NEBRASKA.

BY

A. H. MEYER, IN CHARGE, J. O. VEATCH, AND B. W. TILLMAN,
OF THE U. S. DEPARTMENT OF AGRICULTURE, AND F. A. HAYES,
H. C. MORTLOCK, AND C. E. COLLETT, OF THE
NEBRASKA SOIL SURVEY

THOMAS D. RICE, INSPECTOR, NORTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1916.]



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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,

Washington, D. C., June 6, 1917.

SIR: Under the cooperative agreement with the University of Nebraska, a soil survey of Kimball County was carried to completion during the field season of 1916.

I have the honor to transmit herewith the manuscript and map covering this work and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1916, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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FIGURE.

FIG. 1, Sketch map showing location of the Kimball County area, Nebraska..

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MAP.

Soil map, Kimball County sheet, Nebraska.

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SOIL SURVEY OF KIMBALL COUNTY, NEBRASKA.

By A. H. MEYER, In Charge, J. O. VEATCH, and B. W. TILLMAN, of the U. S. Department of Agriculture, and F. A. HAYES, H. C. MORTLOCK, and C. E. COLLETT, of the Nebraska Soil Survey.—Area Inspected by THOMAS D. RICE.

DESCRIPTION OF THE AREA.

Kimball County is located in the extreme western part of the State of Nebraska. The county adjoins the State of Wyoming on the west and Colorado on the south. It is bounded on the north by Banner County and on the east by Cheyenne County. Kimball, the county seat, is 451 miles by rail west of Omaha. The county is nearly square and has an area of 958 square miles, or 613,120 acres.

Kimball County lies in the physiographic province known as the Great Plains. It is in the western part of this province, in the division known as the High Plains.

Topographically the county consists of a moderately rolling plain, dissected by the valley of Lodgepole Creek, from 1 to 2 miles wide and about 200 feet deep, extending across the center of the county in an east-west direction. It is sharply defined, with broad areas of undulating table-land on each side. The valley is characterized by steep upper slopes, or bluffs, with gentle, extended slopes at the base which merge into a nearly level valley terrace, the profile having roughly the shape of the letter **U**. The creek winding through the valley has a narrow recent flood plain lying about 2 to 4 feet above the stream, which is subject to overflow at infrequent intervals. A well-defined alluvial terrace of smooth, nearly level, or gently sloping topography lies at elevations of 20 to 40 feet above the creek, and a high bench, 60 to 80 feet above, occurs in places, although its outline has been obscured and its original covering of alluvial deposits largely removed by erosion.

The surface of the county is a constructional plain, built up by the deposition of rock débris washed from the Rocky Mountain region to the west in late Tertiary time, the original surface configuration not having been greatly modified by stream erosion. The two areas of upland, popularly referred to as the "table-land" or the "divides," have much the same character of topography. There are numerous shallow drainage ways, so that the land for the most part is slightly rolling, although a considerable part is nearly level. The drainage ways, or "draws," in their upper courses are simply broad, shallow

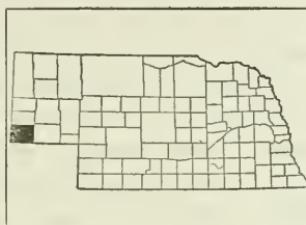


FIG. 1.—Sketch map showing location of the Kimball County area, Nebraska.

depressions with no definite or continuous channel. Along the lower courses of the larger draws, however, the valleys are sharply cut into the plain and are defined on their outer edges by steep slopes or bluffs, which in a few places are rugged and barren of soil. The floors of the small valleys, however, are comparatively wide and nearly level, due to partial filling with alluvium. Small, isolated, level-topped hills or buttes and low, rounded knolls seldom more than 20 to 50 feet above the general level of the surrounding lower lying areas are features of the upland plain. These appear to be erosion forms, and their presence seems to be due to a capping of local beds of hard rock. There are also numerous slight basins or depressions without drainage outlets scattered over the table-land. These are all shallow, lying 20 to 50 feet below the surrounding land, and vary in size from 2 or 3 to about 1,000 acres. They appear to represent original depressions in the constructional plain, but have probably been increased in size by wind erosion.

The general elevation of the county varies from about 4,800 to 5,300 feet above sea level, and the general slope of the plain is eastward. The drainage is principally through Lodgepole Creek, the only stream of importance in the county and a tributary of South Platte River. A small area in the extreme northern part of the county is drained by Rocky Hollow, which flows into Lawrence Fork, a small tributary emptying into North Platte River. Short tributary branches, or draws, occur throughout the upland, and the region is one of very light rainfall, so that no part of the county is poorly drained, except some of the low bottom land along Lodgepole Creek. The draws are dry throughout the year, except immediately after occasional heavy rainstorms. Lodgepole Creek has a small flow of water. It is a perennial stream, although for a few miles of its course in the eastern part of the county it disappears beneath the sand and gravel which fill its channel. The general direction of the drainage is eastward in conformity with the general slope of the constructional plain.

The region is practically treeless; in its natural state it supports a thick growth of grasses. The county lies in what is commonly referred to as the "short-grass country." The principal grasses are grama grass and buffalo grass. The only trees native to the region consist of scattered and stunted pines on the rougher and more broken land along the larger streams and draws, with some cottonwood, box elder, ash, willow, and juniper.

Lodgepole Creek affords a supply of water for irrigation and other purposes, and abundant water is obtained from shallow wells in the valley. On the upland plain water is obtained from wells 100 to 250 feet deep. The water is generally suitable for domestic use, and the quantity is ample for farm and ranch requirements.

Kimball County was organized in 1888, being formerly a part of Cheyenne County. The population consists mainly of native-born Americans who have immigrated from the eastern part of Nebraska and from Iowa and Illinois. There is a small percentage of Swedes and Danes and a small number of Russians, the latter being employed in the cultivation of sugar beets and other special crops. The total population is reported in the census of 1910 as 1,942, all of which is classed as rural. There has been a considerable increase in population, however, since the last census.

The greater part of the population is in the towns and in the Lodgepole Creek valley, the density of the population on the upland plains being less than two persons per square mile.

Kimball, located in the central part of the county and having a population of about 800, is the principal town and the county seat.

The main line of the Union Pacific Railroad west of Omaha passes through the central part of the county and affords good transportation facilities. Some sections along the northern and southern boundaries of the county are remote from the railroad, and the marketing of farm products involves hauls of 15 to 20 miles.

The wagon roads are for the most part ordinary dirt roads, which are not graded or permanently located. However, since there is but little rainfall, they are generally in fair condition throughout the year. The Lincoln Highway passes east and west through the Lodgepole Creek valley and is in good condition for both wagon and automobile traffic. The greater part of the county is supplied with telephone service.

Omaha is the principal outside market for most of the farm products. Wheat is sold at local elevators at Kimball, Bushnell, and Dix. Sugar beets are shipped principally to refineries in Colorado.

CLIMATE.

Kimball County is characterized by cold winters and short summers, with a wide range between the highest and lowest recorded temperatures. The mean annual temperature is reported by the Weather Bureau station at Kimball as 47.5° F.

The mean annual rainfall is about 16 inches, but the precipitation varies widely from year to year. The driest year recorded by the Weather Bureau was 1911, with 9.46 inches of precipitation, and the wettest year 1905, with 25.59 inches. The greater part of the rain falls in the months from April to July, inclusive, while for each of the other months the precipitation commonly averages less than 1 inch. The rain generally occurs in the form of local showers, but occasionally it is torrential in character. The snowfall is light. There is considerably less snowfall than in the eastern part of the State. Local hailstorms are of common occurrence in the summer months.

The average date of the latest killing frost in the spring is May 16, and of the first in the fall, September 21, giving a normal growing season of 128 days. However, frosts frequently occur as late as June and as early as August. The earliest recorded date of killing frost in the fall is August 25, and the latest in the spring, June 5. The grazing season lasts ordinarily from the middle of May to the 1st of November, while some of the grasses cure into hay in a state of nature and furnish some sustenance for stock throughout the winter.

Winds of high velocity are common both in the winter and summer.

The climate in this region is the principal controlling factor in agricultural development. It restricts in various ways the variety of crops grown and has a decided influence on the methods of farming. On account of the small amount of rainfall and its distribution, and the severity of the winters, only drought-resisting and hardy varieties of crops can be grown profitably on the dry land. The growing season is short, and both corn and oats frequently fail to mature grain. Nearly all tree fruits are very uncertain in yield.

The following table is compiled from records of the Weather Bureau station at Kimball:

Normal monthly, seasonal, and annual temperature and precipitation at Kimball.

Month.	Temperature.			Precipitation.		
	Mean.	Absol- ute max- imum.	Absol- ute min- imum.	Mean.	Total amount for the driest year (1911).	Total amount for the wettest year (1905).
December.....	29.2	69	-24	0.60	0.45	0.00
January.....	27.2	73	-33	.43	.91	.65
February.....	26.6	74	-30	.71	.48	1.20
Winter.....	27.7	74	-33	1.74	1.84	1.85
March.....	34.5	82	-17	.98	.20	1.87
April.....	46.0	95	6	2.03	.88	5.57
May.....	54.9	97	8	2.50	.49	4.04
Spring.....	45.1	97	-17	5.51	1.57	11.48
June.....	65.2	102	31	2.26	1.49	4.10
July.....	70.8	106	38	2.46	1.18	3.48
August.....	69.8	104	26	1.54	.80	2.38
Summer.....	68.6	106	26	6.26	3.47	9.96
September.....	60.7	97	19	1.05	1.42	1.57
October.....	48.2	92	4	.72	.91	.73
November.....	36.6	87	-21	.35	.25	T.
Fall.....	48.5	97	-21	2.12	2.58	2.30
Year.....	47.5	106	-33	15.63	9.46	25.59

AGRICULTURE.

The first permanent settlements in Kimball County were made about 1868. The Union Pacific Railroad was extended through the county about this time. The early settlers engaged in ranching, devoting most of their attention to cattle. About 1884 the Union Pacific began to dispose of its land, while some public land was opened to settlement and preemption, and farming began on a small scale. Wheat and corn were the principal crops, but they never proved profitable, because neither the methods of cultivation nor the varieties grown were adapted to the climatic and soil conditions, and in addition prices were low. After several disastrous dry years in the early nineties farming was almost completely abandoned in favor of ranching. Stock raising continued the dominant industry until about 1905, when a Federal law was enacted under which the public land could be homesteaded in tracts of 640 acres, and the lands rapidly passed into private ownership. This had the effect of breaking up the large cattle ranches and giving an impetus to farming. Many of the homesteaders, however, practiced farming for only a short time, and after acquiring ownership of the land sold their holdings to land speculators, so that at the present time only a very small part, about 6 per cent, of the total area of the county is actually under cultivation. On the cultivated land an extensive system of dry farming is carried on, while adjacent unoccupied sections are leased for pasture and hay land, so that stock raising on a small scale is practiced in conjunction with crop production.

Farming under irrigation is practiced to some extent. A part of the valley land in the central part of the county lying to the east and to the west of Kimball is under irrigation. A dam was constructed on Lodgepole Creek, 8 miles west of Kimball, in 1912, for the storage of water. The irrigation district comprises 7,000 acres, of which about 4,000 acres are under cultivation at the present time. Irish potatoes, alfalfa, and sugar beets, given in the order of acreage, are the principal crops. Beans and cabbage are special crops which occupy a relatively small acreage. Wheat, oats, and barley are also grown under irrigation, but only to a very small extent.¹ There is no practicable source of water for the irrigation of the upland. Water from wells is used in a small way for irrigating home gardens.

Wheat is the principal crop in acreage and the chief cash crop of the county. The 1910 census reports 2,178 acres in wheat, but there has been a large increase in acreage in the last few years, due to prevailing good prices and fair yields. The latest estimate available

¹ For a description of the crops grown and methods followed on land under irrigation, see Irrigated Field Crops in Western Nebraska, Bul. 141, Nebraska Agr. Expt. Sta.

is 15,680 acres in wheat in 1915.¹ Both winter and spring wheat are grown, winter wheat occupying the greater acreage. The winter wheat is principally the Turkey Red variety and the spring wheat principally the durum. The yields have shown wide variations in the last 10 years, ranging from less than 6 to as much as 35 bushels per acre. It seems to be the general experience that the winter wheat slightly exceeds the spring wheat in yield.

Corn is generally grown on the upland as a feed crop for use on the farm. The 1910 census reports 3,083 acres in corn, but the Nebraska State Board of Agriculture reports a total of 5,960 acres in 1915.¹ The yields are very uncertain and show wide variations through a period of years, ranging from practically complete failures to 25 to 30 bushels per acre. Both dent and flint corn are grown. The varieties grown produce smaller stalks and smaller ears than those of the eastern part of the State. The White Cap Dent seems to be one of the most successful varieties, and good yields have been obtained from Blueflower Flint and other varieties of this class.

A small acreage of emmer is grown in the county. This crop is seeded principally in the spring, although occasionally small fields of winter emmer are planted.

Oats are grown on practically all the farms operated by the owners, and the crop ranks as one of the most important of the county. The area in oats in 1915 is reported as 7,099 acres.¹ The 1910 census reports 5,584 acres in this crop. The grain yields are very uncertain, but in the most favorable years 40 to 50 bushels per acre are obtained, and a considerable part of the crop is marketed. Very frequently the grain fails to mature, and the crop is cut for forage where the thickness of the stand and height of the plants warrant the labor. Swedish Select is probably the principal variety grown, although other varieties, principally the Kherson, are being grown experimentally.

Rye is sown in the fall and in early spring. The area in rye in 1915 is estimated as 2,202 acres. The greater part of the crop is thrashed for the grain, but it is also used to some extent for hay and pasturage. The crop seems to have about the same soil and climatic adaptation as wheat.

Alfalfa is of local importance as a hay and forage crop. There is an estimated total of about 1,200 acres in the county. The crop is grown principally on irrigated land, but also to some extent on the dry-land farms. The yields under irrigation vary from 2 to 4 tons per acre per season. On the upland alfalfa is both planted in rows and cultivated, and seeded broadcast, the yields being considerably

¹ Annual Report, Nebraska State Board of Agriculture, 1915.

less than on the irrigated land. The quality of the alfalfa grown in the county is good.

Millet is one of the principal forage crops. Its acreage is probably a little greater than that of alfalfa, but its money value is lower. Siberian millet is the principal variety, and considerable hog millet, or proso, also is grown. The 1910 census reports a total of 3,871 acres in tame or cultivated grasses and 5,657 acres in wild, salt, or prairie grasses.

Irish potatoes constitute one of the special cash crops of the county. This crop is grown principally under irrigation in the Lodgepole Valley. The yields are commonly 150 to 175 bushels per acre. It is estimated that about 1,000 acres are devoted to potatoes this year (1916).

Sugar beets also are an important special crop, on irrigated land. The acreage at present is less than that of Irish potatoes. The yields are 8 to 10 tons per acre, and the sugar content is satisfactory. The tops are in local demand for stock feed.

Barley is grown to a small extent, occupying a total of probably 300 to 400 acres. It is utilized as a feed crop on the farms.

Flax is frequently grown as a first-year crop on sod land. There is a small acreage of sorghums grown for forage, amber cane probably being the principal variety with which any success has thus far been obtained. Cabbage and beans are minor special crops on irrigated land, and the latter crop has been grown in an experimental way with fair results on dry-land farms. Sweet clover is being tried under dry-farming methods and gives some promise of being a profitable forage crop.

Fruit has not yet been grown in sufficient quantity to supply even the small local demand. The climate is too severe for most tree fruits, injury resulting especially from the late spring frosts. Plum trees are most certain of yielding fruit. Among the small fruits, gooseberries and currants seem to give the best results.

Common garden vegetables generally can not be grown successfully except with irrigation.

Stock raising is regarded as a profitable industry, although conditions at present are not favorable for carrying on ranching on an extensive scale. Cattle rank first in number, followed by horses and sheep. Most of the stock raising is done in combination with farming, each farmer commonly leasing from one to three unoccupied sections for pasture. The native pasture ordinarily supports one cow or steer on 20 or 30 acres, and the forage grown on the farm with some wild hay is sufficient to carry the stock through the winter.

Small numbers of cattle, sheep, and hogs are fed for market in good crop years. Alfalfa is the principal feed crop, while corn, bar-

ley, beet tops, oats, emmer, and such other feed and forage crops as may have succeeded during the season are utilized.

Dairying is carried on to a small extent, but is a comparatively unimportant industry. Sufficient milk and butter is produced to supply the local demand, and small shipments are made to outside points. A small creamery has been established at Kimball.

In general, the farmers who have had experience in the region have selected the heavier and deeper soils as best adapted to small grains and as capable of withstanding drought. Such soils in this county are the more nearly level loam and silt loam types. The gravelly and coarse sandy types are regarded by the farmers as not being suitable for any purpose other than pasture. In the irrigated area the finer textured soils with the deepest and least pervious subsoils, rather than those with coarse, gravelly layers in the 3-foot section, are selected for the special crops.

The county is in an initial stage of development, and many of the recent settlers are men of very limited means. The farm improvements therefore can hardly be expected to compare favorably with those of the older parts of the State where agriculture is on a more stable basis. On most farms the buildings are very small and roughly built, and some sod houses are still to be seen.

The cattle on the farms are of good grades, the Hereford blood predominating in the herds of beef cattle and the Holstein in the dairy herds. Most farms have from three to six horses of heavy-draft type. All the farms are equipped with the modern labor-saving machinery required for grain farming on an extensive scale. Tractors are extensively used for breaking land. Machine diggers and mechanical sorters are in use for harvesting the potato crop.

In the tillage of the dry land it is the aim to maintain as loose a surface soil as possible under the climatic conditions in order to conserve moisture, without entirely pulverizing the soil. A slightly cloddy or rough surface is necessary to prevent excessive shifting of the soil by winds. Summer tillage for winter grain has been tried in a small way, but it is not agreed that it is profitable. So far as experiments have been made, fall plowing for spring wheat and oats has not produced appreciably greater yields.

In preparing new land for wheat the soil is broken to a depth of 3 or 4 inches with mold-board plows and heavy teams or tractors. The sod is then disked and the wheat drilled in immediately. Under another plan, the plows are followed by rollers or packers and the grain seeded without further preparation. Where wheat follows wheat the grain is frequently drilled in without any preparation of the land, the drill sometimes following the binder. Wheat is also planted between corn rows before that crop is harvested.

Generally but very little labor is used in the preparation of the land for corn and in the cultivation of the crop. Frequently the grain is planted in the roughly broken sod without disking of the furrow slices or subsequent cultivation.

In the irrigated area there is a more thorough preparation of the land, careful cultivation, and scientific methods of watering the land and handling the crops.

Systematic plans of crop rotation have not been seriously considered on the dry land. Farming is comparatively new; to a large extent it is still experimental, and the agricultural conditions are more or less unstable.

In the handling of crops, wheat is generally stacked in the open, whether it is cut with the binder or the header. On account of the thinly settled condition of the country, there are but few threshing machines, and it is generally late in November before all the crop is threshed. The grain, as far as possible, is marketed direct from the machines. When corn properly matures and yields well, the ears are pulled from the standing stalks and stored for winter feed; otherwise stock is turned into the fields and allowed to feed on the crop. The forage crops are stacked in the open and used as required for winter feeding. Stock feeding for the market, principally sheep and cattle, is carried on during the winter months.

Commercial fertilizers are not used, and it is generally believed that there will be no necessity for them in the immediate future.

Farm laborers are scarce. The ordinary day wage during the busier seasons is \$2.50 or \$3. Where labor is hired by the month, \$30 to \$35 is paid. Most of the farmers, however, do their own work or require but little extra labor. Russians and Japanese are employed in the production of beets and other special crops, both on a share plan and for wages.

The greater proportion of the farmers own their farms, and there is only a very small percentage of tenants.

Most of the land has been homesteaded or purchased in tracts of 640 acres. Many farmers lease extra sections for pasture and wild hay, and there are a number engaged principally in stock raising who have holdings, either by ownership or under lease, ranging from 3 to 20 sections.

The upland best suited to farming has a selling price of \$10 to \$25 an acre. Sections containing a small area adapted to grain growing, but mainly of value for pasture, may be bought for \$5 to \$10 an acre. Most of the land under irrigation is valued at about \$60 an acre.

SOILS.

Kimball County lies between the steppes and the desert. It lies in a region where the moisture supply is too low to permit the accu-

mulation of a great deal of organic matter in the soil, notwithstanding the fact that its native vegetation consists of grasses. The rainfall is too low also to allow the leaching of the whole soil layer. Thus the carbonates are leached from the surface layer but are found in abundance in the subsoil. On the other hand, the county lies where the moisture supply is too great to permit the growth of a desert shrub vegetation and the development of the gray soils rich in carbonates characteristic of such regions. In development the well-drained soil on the upland of the county, regardless of its texture, has reached a stage of maturity, and because of uniformity both of climatic forces and of parent material it is uniform in its characteristics. It belongs to the important group of chestnut-colored soils marked by their brown surface color, their lighter colored and rather compact subsurface, and their highly calcareous subsoil. To all intents and purposes the upland of the county is covered with a single soil with minor variations due to the fineness or coarseness of the material. The Sidney loam and Sidney silt loam are the varieties, or, as they are designated in the nomenclature of the Bureau of Soils, the types that represent the most complete stage of development.

The terrace soils of the county, represented typically by the Tripp series, have reached practically the same stage in soil development as the upland soil, while the recent alluvium has just begun its development. Its profile is not determined by the soil-making forces characteristic of the region but by the geological processes operating during its deposition. It is a geological formation in its stage of development and is not a soil in any other sense than that it is capable of supporting a growth of plants.

The soils along the steep slopes are in a sense nothing but the disintegrated débris of the geological formations, and have not yet reached the mature stage of soil development.

The soils have been derived almost entirely from a single geologic formation. In this area this consists of a great thickness of sand, gravel, and silt containing a high percentage of lime, in the form of very finely divided calcium carbonate disseminated throughout the material and in coarse fragments of calcareous rocks.

The beds have generally been cemented through the action of calcium carbonate, forming a white calcareous grit and conglomerate of varying degrees of hardness, to which the name "mortar beds" has been applied. The formation is heterogeneous, containing fragments of practically all the great variety of igneous and sedimentary rocks of the Rocky Mountain region to the west. Quartz, feldspar, and pebbles of granite probably predominate.

The formation is of late Tertiary age (Pliocene) and probably of fluvial and lacustrine origin. In the general geologic mapping

which has been carried on in this region it has been named the Ogallala formation.

Recent-alluvial material, consisting of fine sand and silt overlying gravel derived from the Ogallala formation, has been laid down in the valley of Lodgepole Creek, and the valleys of the larger draws have been partially filled by relatively coarser alluvial wash to a thickness of 5 to 15 feet. A small deposit of alluvial-fan material is spread out at the mouths of the draws entering the Lodgepole Valley, and considerable recent-alluvial material is found at the bases of practically all the steeper slopes. There are also in places thin deposits of grayish or yellow very fine sand and silt on the slopes at the bases of the bluffs inclosing Lodgepole Valley, which appear to be wind deposits.

The soil separations that have been made bear a close relation to the different lithologic phases of the Ogallala formation and to local differences in topography.

The extent and character of the weathering determined by the conditions of a semiarid climate have had a marked effect upon the color, structure, and lime content of the soil. The prevailing color of the soils is light brown at the surface, with grayish or pale-yellowish subsoils. In general the soils have a loose, friable structure, although the heavier types are moderately compact at the surface. The material is generally calcareous, particularly in the subsoil, and shows an alkaline reaction, although there is no surface manifestation of injurious alkalies and no appreciable injury to plant growth from this cause. The organic-matter content is apparently low, compared with that of the more humid sections in the eastern part of the State.

It is estimated that about 85 per cent or more of the county would be arable land if supplied with sufficient moisture. Under the limitations of normal rainfall about 55 per cent of the area is suitable for cultivation under dry-farming methods, provided the crops are chosen with regard to the soil and climatic conditions.

In the system of mapping employed by the Bureau of Soils the soils are grouped in series on the basis of common characteristics in color, structure, and origin, and the series are subdivided into types on the basis of texture, or the relative proportion of different-sized mineral particles. Five series, including 12 types of soil, in addition to Rough broken land, are recognized in Kimball County. One type is represented only by a phase.

The Sidney series comprises upland soils in the northern Great Plains region. It is characterized by light-brown surface soils and a lighter colored, usually light-gray or pale-yellowish, subsoil. The subsoil material is highly calcareous, and the surface soil is moderately so. The subsoil is loose and friable or mealy, and in the

heavier types the surface material is commonly more compact and coherent than the subsoil. The series is mainly residual in origin, and in this county the soil material is derived almost entirely from the Ogallala formation. The soils are well drained and are productive under favorable conditions of rainfall. This series includes practically all the upland or dry-land soils of the county, amounting to 87.6 per cent of the total area. Five types are represented, the gravelly sandy loam, fine sandy loam, very fine sandy loam, loam, and silt loam.

The Scott soils differ in physical characteristics from the Sidney, chiefly in the more compact structure of the subsoil. The soil has originated in the shallow depressions or basins which are a feature of the upland plain. The material is principally colluvial from adjacent slopes, which in this area are occupied by the Sidney soils. It has been formed under conditions of poor drainage. The series occupies a comparatively small area and is of minor agricultural importance. It is represented only by the silt loam, calcareous phase.

The Tripp series is characterized by light-brown and gray colors in the surface soil and light-gray and pale-yellow colors in the subsoil. The subsoil is highly calcareous. The series occurs on alluvial terraces above overflow along the streams in the western or semiarid part of the Great Plains. In Kimball County the soil material has been modified to some extent by wash from adjacent slopes and by wind-blown material. The Tripp soils differ from the Cheyenne principally in having less gravel in the subsoil and therefore being less pervious. The land is well drained and is productive under irrigation. Only one type, the Tripp very fine sandy loam, is encountered in Kimball County.

The soils of the Cheyenne series are derived from alluvial-terrace material and from alluvial and colluvial wash which has partially filled the valleys of streams and draws in the western part of the Great Plains region. The soil is light brown at the surface, with a grayish or pale-yellowish subsoil. The subsoil is gravelly or coarse in texture and loose and porous in structure. It has a high lime content. The land is well drained and lies above overflow. The soils are droughty and are not very well adapted to irrigation where the supply of water is small. Four types, the gravelly sandy loam, the fine sandy loam, very fine sandy loam, and loam, are mapped in Kimball County. These soils are of small extent.

The Laurel series includes light-brown to pale-yellowish soils occurring in the first bottoms along streams in the western part of the Great Plains region. There is characteristically a porous gravel stratum in the lower subsoil or the underlying material. These soils have the same structure as the Cheyenne and the same mineralogic

character, the differences between the two being due to the more recent origin and lower topographic position of the Laurel. The series is represented in this county by a single type, the very fine sandy loam.

The following table gives the actual and relative extent of the several types. Their distribution over the county is shown on the accompanying map.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Sidney loam.....	247,360	40.3	Cheyenne fine sandy loam.....	7,424	1.2
Sidney gravelly sandy loam.....	177,472	28.9	Sidney very fine sandy loam.....	6,784	1.1
Sidney silt loam.....	78,272	12.8	Laurel very fine sandy loam.....	5,696	.9
Sidney fine sandy loam.....	27,712	4.5	Cheyenne very fine sandy loam.....	4,992	.8
Cheyenne loam.....	25,472	4.2	Scott silt loam—calcareous phase.....	3,264	.5
Cheyenne gravelly sandy loam.....	10,176	1.7	Total.....	613,120
Rough broken land.....	9,600	1.6			
Tripp very fine sandy loam.....	8,896	1.5			

SIDNEY GRAVELLY SANDY LOAM.

The Sidney gravelly sandy loam is a light-brown sandy loam containing a high percentage of fine and coarse gravel, which gives the type a loose, porous structure. There is very little textural difference between the soil and subsoil. The brownish color extends to a depth of 8 to 15 inches, where the material becomes grayish or pale yellowish and is notably more calcareous than at the surface. The gravel consists of both angular and waterworn fragments of the great variety of crystalline rocks contained in the underlying Ogallala formation, together with a smaller percentage of white fragments of calcareous grit. This type is locally distinguished as "hard-gravel" land, where mostly from crystalline rocks, and "soft-gravel" land, where mainly from calcareous rocks.

The principal areas of the Sidney gravelly sandy loam lie north and west of Kimball, on the north side of Lodgepole Creek, but smaller areas are widely distributed throughout the county. The type occurs as ragged patches and irregularly outlined belts conforming in a general way to the direction of the drainage lines, and occupies isolated knolls and low ridges.

The topography is rolling and hilly, and in general the land is characterized by steeper slopes and a more gullied surface than the loam and silt loam types of this series.

The type is porous, is not retentive of moisture, and is poorly adapted to farming in a region of light rainfall. The character of the topography also is unfavorable for extensive farming. It supports a fairly thick growth of grama, buffalo, black-root, and bunch

grass and affords good grazing, but not as good as the heavier soils. The land under present conditions is valued at \$5 to \$10 an acre for pasture.

A loamy variation of this type is widely distributed throughout the upland of the county, occurring principally in areas of 4 to 300 acres extent. This variation occupies the tops and slopes of the numerous isolated buttes, but occurs principally on the steep slopes or bluffs inclosing the valleys of draws and on the rims of the small basins which are a feature of the plains topography.

This variation is not cultivated, and because of the coarse gravelly character and droughty nature of the soil, it is not regarded as suitable for farming in this region. The growth of native grasses is less luxuriant than on the silt loam type. Bunch grass is more abundant than on other soils, and the growth of yucca in Kimball County is confined mainly to this type.

SIDNEY FINE SANDY LOAM.

The Sidney fine sandy loam is a light-brown soil containing a high percentage of fine and very fine sand and possessing a loose, friable structure. The color becomes lighter with depth, and the soil apparently contains but little organic matter below 12 to 18 inches. The subsoil is grayish, friable or mealy, highly calcareous, and otherwise conforms to the characteristics of the Sidney series.

This type is found principally on the slopes above the bench land in the Lodgepole Valley, but also occurs in smaller areas on the table-land in association with the gravelly sandy loam type. The soil in places is partly colluvial in origin, the surface consisting principally of fine and very fine sand washed down from adjacent slopes occupied by sandy soils.

The type occurs on slopes or is characterized by a moderately rolling topography, allowing a relatively rapid run-off of rainfall, so that conditions are not altogether favorable for the retention of moisture. The land, however, is not gullied or eroded and has a topography favorable for farming.

Only a very small part of this type has been brought under cultivation. The soil does not withstand drought quite so well as the heavier soils and more nearly level lands, and since the surface soil is less coherent, it is a little more subject to drifting. However, under favorable conditions of rainfall fair yields of wheat and other crops grown in the county are obtained.

The land at present is valued chiefly for grazing. It supports a good growth of the common native grasses and is capable of maintaining a larger number of live stock than the gravelly sandy loam type.

In the following table are given the results of the mechanical analyses of samples of the soil and subsoil of the Sidney fine sandy loam:

Mechanical analyses of Sidney fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
372524	Soil.....	1.4	10.5	9.4	38.0	24.3	8.2	8.4
372525	Subsoil.....	1.6	9.0	7.4	31.0	23.0	11.9	16.0

SIDNEY VERY FINE SANDY LOAM.

The Sidney very fine sandy loam is very similar in color and other characteristics, as well as in the lithologic character of the soil section, to the loam and silt loam types, differing from those types in having a slightly higher content of very fine sand in the surface soil. As a result of this slight textural difference the soil apparently is less coherent in structure.

The principal areas are encountered south and west of Bushnell, but small bodies are distributed throughout the upland of the county. Many areas are too small to be shown separately on the soil map and are included with other types of the series.

This type occurs as nearly level or gently undulating land both on the highest parts of the table-land and in shallow depressions, and also to some extent on very gentle slopes in Lodgepole Valley, where the higher slopes are occupied by the fine sandy loam and the gravelly sandy loam of the Sidney series.

All this land is arable, and where cultivated it seems to have about the same crop adaptation and agricultural value as the loam and silt loam types.

In the following table are given the results of the mechanical analyses of samples of the soil and subsoil of the Sidney very fine sandy loam:

Mechanical analyses of Sidney very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
372503	Soil.....	2.0	6.6	4.8	16.8	32.8	24.1	12.7
372504	Subsoil.....	.4	2.8	2.2	9.3	36.7	26.4	12.2

SIDNEY LOAM.

The soil of the Sidney loam is a light-brown, mellow loam 12 to 18 inches deep. It is characteristically fine in texture, containing a

relatively high percentage of silt and only a very small quantity of coarse material, except in local spots where gravel has been brought to the surface by burrowing animals. The subsoil is a grayish or white silty loam. It contains a higher percentage of coarse particles than the surface material, these consisting of white gravelly fragments of calcareous rock and coarse sand resulting from the disintegration of the underlying formation. The color gradually becomes lighter with depth, and apparently the soil does not contain any considerable quantity of organic matter below about 18 or 20 inches, at which depth there is a rather abrupt change to the gray or white color of the subsoil.

The surface material apparently is only moderately calcareous. It does not effervesce with acid until a depth of 12 to 15 inches is reached. The subsoil characteristically is highly calcareous. The loamy surface soil becomes slightly more compact at 10 to 12 inches, without changing materially in texture, this condition apparently being due to mineral cementation rather than to a concentration of clay. The grayish subsoil, which is reached at depths of 18 to 24 inches, is more friable and pervious than the surface material. The subsoil on the whole appears to be rather a product of disintegration than of decomposition, and it gradually becomes coarser until it grades into the hard or but little disintegrated, white calcareous grit of the Ogallala formation at a depth of 3 to 5 feet. The thickness of soil material having a structure favorable for the retention of moisture does not generally exceed 3 feet.

The Sidney loam is widely distributed over the upland plain throughout the county, occurring both in small and in extensive areas. The topography is nearly level or gently undulating in the larger areas. Some of the smaller areas occur as narrow strips of gently sloping land at the base of steep slopes occupied by gravelly types of the series and also in shallow, basinlike depressions at the heads of draws.

All the areas have good though not excessive surface drainage and underdrainage. They are not subject to erosion.

The Sidney loam is the most extensive soil type of the county. It is arable and well suited to farming under semiarid conditions. At present, however, probably not more than 3 per cent of it is under cultivation. The remainder is utilized for grazing.

Wheat is the principal crop, both winter and spring varieties being grown. There is a smaller acreage of corn and oats, and several other crops, including rye, barley, millet, amber cane, and alfalfa, are grown in a small way.

The yields of all crops show wide variations from year to year, depending mainly upon the amount and distribution of rainfall. Wheat yields in the last 10 years have ranged from less than 10

bushels per acre, or practically crop failures, to as much as 25 or 30 bushels under the most favorable conditions. Corn rarely yields more than 20 bushels per acre. In many seasons the grain fails to mature, and during the driest years there is scarcely any fodder. Oats generally attain sufficient growth to be cut for hay, and in favorable years, where care has been exercised in the selection of seed and planting has been done at a favorable time, yields of as much as 40 bushels per acre have been obtained. Millet does not often fail to furnish forage.

The soil supports a thick growth of native short grasses, principally grama and buffalo grass, and furnishes good grazing for cattle and horses. Except where the grass is injured by unusual drought, the land commonly has a carrying capacity of one cow or steer to 15 or 25 acres. In the lower lying areas some grasses make sufficient growth to be cut for hay.

The sod land is generally broken to a depth of about 4 inches, and as soon as possible thereafter it is disked and gone over with some form of harrow or with a roller in order to fill up the spaces between the furrow slices, a practice necessary to prevent excessive loss of moisture. The soil under cultivation is kept in a slightly rough or lumpy condition to prevent blowing. Under favorable moisture conditions this type is mellow and loamy and easily worked, but after periods of drought it becomes more compact, so that plowing and the preparation of a good seed bed are difficult or impracticable.

Improved land of this type has a selling price of \$15 to \$20 an acre, and unimproved land a value of \$10 to \$15 an acre.

SIDNEY SILT LOAM.

The soil section of the Sidney silt loam is very similar to that of the loam type. The surface soil is a light-brown, mellow silt loam, generally fine in texture. There is no considerable percentage of particles coarser than fine sand and no gravel. At a depth of about 10 or 12 inches the material becomes slightly more compact, but it again becomes friable and mealy in structure at about 18 or 20 inches, and grades into the grayish, highly calcareous silty subsoil. Gravel is encountered at 3 or 4 feet, but generally the soil layer is thicker than in case of the loam.

This type is mapped in the upland part of the county in close association with the loam, occurring both in extensive tracts and as small isolated areas. It occupies the more nearly level, higher land and also the lower lying parts of the shallow drainage depressions that occur throughout the upland plain. The level topography favors the retention of the rainfall, and in this respect the type has a slight advantage over the loam and other types of the Sidney

series. The topography also is favorable to an extensive type of farming. In the deeper basins the soil is usually more compact and more closely resembles the Scott silt loam, calcareous phase.

All the type is arable, and it is probably better adapted to farming than any other soil in the county under the prevailing climatic conditions. At present, however, probably less than 20 per cent of the land is under cultivation. Wheat is the principal crop, followed by oats and corn. Rye, barley, millet, amber cane, alfalfa, and emmer are grown in small patches and in an experimental way. Yields of as much as 35 bushels of wheat per acre have been obtained under favorable conditions where the land has been properly prepared and seeded at a favorable time. The average yield, however, for a period of years is probably about 10 bushels. On account of the climatic conditions corn does not often mature properly, and the yields are low. Oats attain sufficient growth to furnish hay nearly every year, and in favorable seasons yields of 30 to 40 bushels of grain per acre are obtained.

The soil has a friable, loamy structure when it contains a normal amount of moisture and is easily plowed and prepared for small grain, but it tends to become hard after long droughts.

In its natural condition this type supports a thick growth of grasses, principally grama grass and buffalo grass, which afford good grazing both in summer and in winter. In the lower situations the grasses attain sufficient height to be cut for hay.

This land has a selling price of about \$20 an acre.

SCOTT SILT LOAM, CALCAROUS PHASE.

The upper soil of the Scott silt loam, calcareous phase, is a light-brown or dark-gray silt loam, generally high in silt and containing very little coarse material. This stratum has a moderately compact structure. At a depth of 4 to 8 inches the material passes into a light-brownish silty clay loam, which is very compact in structure and like hardpan. At depths varying from 20 to 24 inches this layer becomes gray or drab, coarser in texture, and more friable in structure. It is almost impossible to bore through the hardpan subsoil with the soil auger, although the material when brought to the surface is crumbly and mealy, suggesting that the compact structure may be due more to a cementing by mineral salts than to the concentration of clay. The soil effervesces freely with acid at a depth of 15 to 20 inches, indicating a high lime content in the subsoil.

Small areas of soil included with this phase are a silty clay loam or clay, such areas representing a lower lying and more poorly drained variation of the phase. The soil is tougher and more impervious than the silt loam and is locally known as "gumbo."

The Scott silt loam, calcareous phase, is widely distributed in the depressions which occur over the upland plains of the county, but is found principally in the southern part. It occurs in separate small bodies ranging from about 3 to 50 acres in extent, with one larger area of about 1,000 acres west of Gifford.

The soil material has been deposited in shallow basins and consists of sediment from soils of the table-land. In places, owing to the impervious nature of the subsoil, water accumulates in small ponds after heavy rains and disappears very slowly, so that poor drainage is prevalent over a large part of the phase.

Only a very small part of this soil is under cultivation. It is more difficult to plow the land and prepare a good seed bed than on the associated soils of the Sidney series, but the topography is more favorable to the retention of moisture. The areas support a thick growth of native grasses, except in the areas of standing water.

The following table gives the results of the mechanical analyses of samples of the soil and subsoil of the Scott silt loam, calcareous phase:

Mechanical analyses of Scott silt loam, calcareous phase.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
372517.....	Soil.....	5.4	8.6	3.5	6.6	18.2	42.9	14.8
372518.....	Subsoil.....	5.9	15.4	8.8	13.6	9.4	20.9	25.8

TRIPP VERY FINE SANDY LOAM.

The surface soil of the Tripp very fine sandy loam consists of a light-brown, very fine sandy loam, relatively high in the finest grade of sand and in silt, and low in all the grades of material coarser than fine sand. The soil is from 15 to 20 inches deep and is underlain by gray or pale-yellowish material, differing only slightly in texture from the surface material, though possibly containing a somewhat higher percentage of silt. At a depth of 10 or 12 inches there is commonly in the soil a subsurface layer which is a little more compact than the surface soil, but the material at 20 to 24 inches becomes dry, mealy, and friable. The surface soil apparently is only moderately calcareous, but the lime content increases with depth until the grayish, highly calcareous subsoil is encountered, at a depth of 20 to 24 inches.

This type is very similar in physical characteristics to the Cheyenne very fine sandy loam, from which it differs chiefly in the greater depth of the soil material over the gravelly substratum underlying all the alluvial deposits of the county.

This type is confined to the Lodgepole Valley, where it occurs as alluvial terraces or benches lying 20 to 60 feet above the creek level. The land is nearly level, but has sufficient slope to effect thorough drainage. The topography is favorable for irrigation.

The greater part of the Tripp very fine sandy loam is in cultivation, being farmed both by dry-land methods and under irrigation. It seems to retain water better and has proved more productive than the other valley soils.

With irrigation both special crops and general farm crops are grown. Irish potatoes, alfalfa, and sugar beets are the more important products, ranking in point of acreage in the order named. Wheat, corn, and oats are grown chiefly by dry-farming methods, but to a small extent under irrigation. Cabbage and beans are special crops grown on a small acreage.

The yields of potatoes under irrigation range from about 150 to 175 bushels per acre. Sugar beets produce 8 to 10 tons per acre, and alfalfa 3 to 4 tons from three cuttings per year. Wheat yields about 20 to 25 bushels under irrigation. Yields of 20 to 30 bushels of corn are obtained when the season is favorable for maturing the grain, although very little is grown. Under dry-farming methods the yields of grain vary widely, depending on the season. The land apparently has about the same agricultural value as the Sidney loam and silt loam of the table-land.

The soil is loamy and easily tilled, but does not drift, its coherency being sufficient to prevent this. It does not puddle to any serious extent when irrigated. No accumulation of alkali sufficient to cause injury to plants has taken place.

Land of this type of soil, under irrigation, has a selling price of \$60 to \$75 an acre.

CHEYENNE GRAVELLY SANDY LOAM.

The Cheyenne gravelly sandy loam, to a depth of 4 or 5 inches, consists of a light yellowish brown fine sandy loam containing varying quantities of gravel. The subsoil, beginning at a depth of a few inches, is a porous mass of unconsolidated, grayish sand and gravel, extending to depths of 3 to 10 feet. The soil contains only a small admixture of organic matter.

This type occurs as narrow strips of alluvial wash in the beds of the larger draws, and also in filled channels of Lodgepole Creek. It has no value for farming, either under dry-land methods or irrigation. It supports a very sparse growth of grasses, sand grass being the only species of much value, and it is therefore of little worth even as grazing land.

CHEYENNE FINE SANDY LOAM.

The surface soil of the Cheyenne fine sandy loam typically is a light-brown or grayish, loose fine sandy loam, about 10 to 15 inches in depth. The subsoil is characteristically lighter in color than the surface material, and coarser in texture, containing a high percentage of gravel either within the 3-foot section or in the immediate substratum. In the deeper phases there is commonly a light-gray, highly calcareous layer between the surface soil and the underlying gravel bed.

The type occurs as narrow, irregular patches on the alluvial terrace, or bench land, lying 10 to 40 feet above Lodgepole Creek, and is also found on the level valley floors of the larger draws, where it is 3 to 10 feet above the drainage channels. The surface is nearly level or slightly undulating, but is dissected by the meandering stream channels and tributary draws.

The type is of small extent and of minor agricultural importance. The land is droughty when farmed under dry-land methods and has too free underdrainage, especially in the shallow areas, to be successfully irrigated.

The soil does not support as thick a growth of grasses as the heavier types, and it has a lower grazing value. There is a smaller proportion of grama and buffalo grasses than on the loam and silt loam soils of the upland. The creeping prickly-pear cactus of this region seems to show a preference for this and similar dry sandy types.

CHEYENNE VERY FINE SANDY LOAM.

The soil of the Cheyenne very fine sandy loam consists of a light-brown or brown very fine sandy loam about 15 to 20 inches in depth. This grades rather abruptly into a light-gray, very fine sandy loam or silt loam, having a mealy, friable structure, and this in turn rests upon a bed of coarse sand and gravel at depths of 3 to 4 feet. The color indicates a fair content of organic matter to a depth of 10 to 12 inches, where the material becomes lighter in color and increasingly calcareous.

This type is confined to the valley of Lodgepole Creek, in which it occupies alluvial terraces lying 15 to 40 feet above the creek level.

The topography is nearly level or gently sloping. The land is well drained, and the surface is favorable for irrigation. The porous character of the subsoil permits free underdrainage.

The greater part of the type is under cultivation. Alfalfa, Irish potatoes, and sugar beets are the principal crops grown under irrigation. The yields are about the same as, or slightly lower than, those obtained on the Tripp very fine sandy loam, in which the porous gravelly substratum lies at greater depths. Under dry-land

farming the soil seems somewhat less retentive of moisture than the Tripp soil or upland soils such as the Sidney loam and silt loam, and it is a little more susceptible to drifting than these Sidney types. However, in favorable seasons good yields of wheat and other crops adapted to this region are obtained.

The following table gives the results of the mechanical analyses of samples of the soil and subsoil of the Cheyenne very fine sandy loam:

Mechanical analyses of Cheyenne very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
372515	Soil.....	4.8	9.8	6.3	18.2	26.8	23.4	10.6
372516	Subsoil.....	13.4	31.8	18.0	19.4	5.7	4.4	7.1

CHEYENNE LOAM.

The Cheyenne loam consists of a light-brown, fine-textured loam, 10 to 15 inches deep, underlain by a grayish or yellowish, friable calcareous loam. A porous layer of unconsolidated sand and gravel is encountered at a depth of about 3 feet. This type does not differ materially from the fine sandy loam and very fine sandy loam of the series, except in the texture of the surface soil.

The type is widely distributed throughout the county, but is confined to the valleys of the larger draws, where it occurs as narrow, elongated strips conforming with the direction of the drainage. It is derived from the older alluvial wash which fills the valleys and occupies low terraces lying 6 to 10 feet above the drainage channels.

The surface is nearly level, but has sufficient slope to allow much of the rainfall to run off. Owing to the porous character of the gravelly subsoil the underdrainage is rather free.

The valleys are comparatively narrow, and the areas of this soil are irregular in width and extent, owing to the meandering of the drainage channels, so that most of the land is unsuitable for extensive farming. The areas are not favorably situated for irrigation, and the soil has a tendency to be droughty. Very little farming has been attempted. The type supports a good growth of native grasses and is valued chiefly for pasture.

LAUREL VERY FINE SANDY LOAM.

The Laurel very fine sandy loam is a light yellowish brown or dark-grayish, slightly coherent very fine sandy loam, underlain at depths of about 3 feet or less by coarse sand and gravel. The soil material commonly becomes lighter in color with depth, as the organic-

matter content decreases, but there is little difference in the texture and structure of the material above the basal bed of gravel. The soil apparently is less calcareous than the older soils of the county. Some areas of fine sandy loam and silt loam are included with this type, but the minor agricultural importance of the series in this area does not warrant the making of fine textural distinctions.

The Laurel very fine sandy loam is confined to the Lodgepole Valley, where it occurs as narrow strips of first-bottom land representing the most recent alluvial deposition. The flood plain is 2 to 6 feet above the creek level, and the type is subject to occasional overflow. The land is for the most part poorly drained, not only on account of its low topographic position and the shallow depth to the water table, but also on account of considerable seepage from adjacent, higher lying irrigated land.

This type is not cultivated, but it supports a good growth of wild grasses which afford both hay and pasturage.

ROUGH BROKEN LAND.

Rough broken land includes the rocky bluffs and the more eroded and gullied land along the deeper draws. It is characterized by rock outcrop, and much of it is nearly barren of soil. It has no value for farming, but supports a sparse growth of grasses in the small secluded patches of Sidney gravelly sandy loam and fine sandy loam, and these afford some grazing. In a few places there is a scattered growth of stunted pine common to the region.

The principal areas of Rough broken land occur near the western boundary of the county along the tributary draws on the south side of Lodgepole Creek, along Rocky Hollow near the northern county line, and along Sidney Draw in the extreme southeastern part of the county.

SUMMARY.

Kimball County is in the extreme western part of Nebraska. It comprises an area of 958 square miles, or 613,120 acres.

The county lies within the great plains physiographic province of the United States. Topographically it is a high, nearly level to moderately rolling generally treeless plain. The only stream of any considerable size is Lodgepole Creek, a tributary of South Platte River. The general elevation of the plain is 4,800 to 5,300 feet above sea level.

The county is thinly settled and contains no large towns or cities. Transportation facilities are afforded by the Union Pacific Railroad, which passes east and west through the central part of the county.

The county has a semiarid climate. The mean annual rainfall is about 16 inches, the precipitation occurring principally in the

months of April to July, inclusive. The mean annual temperature is reported as 47.5° F. The winters are long and are characterized by low temperatures. There is a normal growing season of 128 days.

The early agriculture of the area consisted entirely of raising cattle on the open range. Farming has been carried on in a small way since about 1884. The present agriculture consists of an extensive type of dry-land farming combined with stock raising and of some intensive cropping under irrigation. Only about 6 per cent of the area of the county is under cultivation.

Of the crops grown, wheat occupies the largest acreage and is the most successful crop grown under dry-farming methods. It is the chief cash crop. About 7,000 acres in the Lodgepole Valley is under irrigation, and about 4,000 acres of this land is under cultivation, chiefly to Irish potatoes, alfalfa, and sugar beets.

The soils of the county are prevailingly light brown in color at the surface, with grayish, highly calcareous subsoils having a loose, friable structure. Over the greater part of the county the soils are residual in origin, the material being derived entirely from a single geologic formation. The soils derived from alluvial deposits constitute about 10 per cent of the area of the county. Loam soils predominate, followed by fine sandy loam and silt loam types.

The soils of the upland plains are included principally in the Sidney series. The soils occupying alluvial terraces or benches are classed with the Cheyenne and Tripp series, and the recently formed bottom land is classed with the Laurel series.

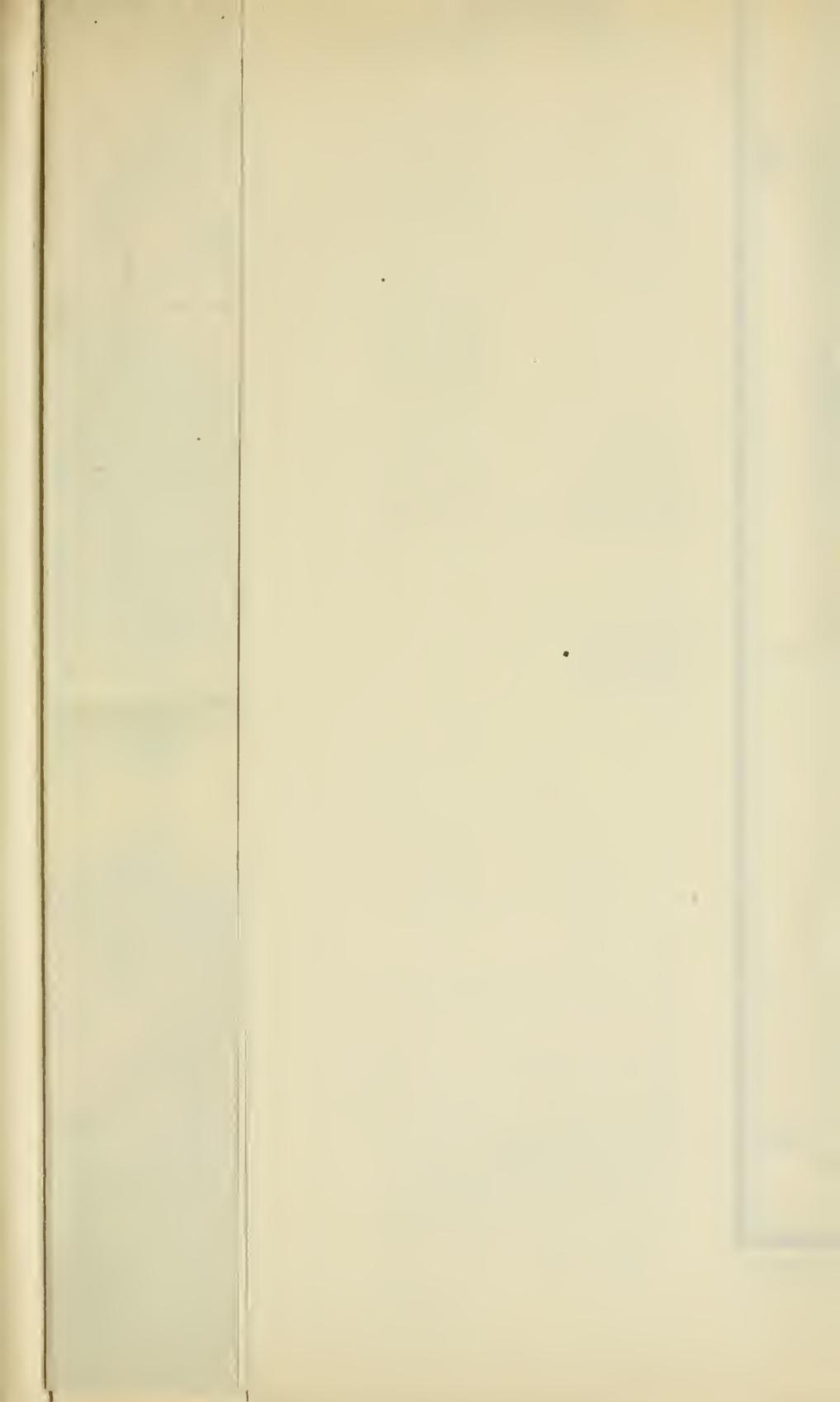
The Sidney series is represented by five types and constitutes about seven-eighths of the total area of the county. These types have light-brown surface soils and a lighter colored subsoil. The Sidney soils are mainly residual in origin. They are well drained and productive under favorable conditions of rainfall.

The Cheyenne soils are derived from alluvial-terrace material with some colluvial wash. The soil is light brown, and the subsoil is grayish or pale yellowish and coarse and porous. The soils are well drained but droughty. These soils are of small extent in Kimball County.

The Tripp series comprises light-brown or gray surface soils and a light-gray or pale-yellow subsoil. These soils occupy alluvial terraces. They are well drained and productive under irrigation.

The soils of the Laurel series are light brown to pale yellowish, with a gravelly stratum in the lower part of the subsoil. These soils are comparable with the Cheyenne, but occupy a lower topographic position and are not so well drained.





SOIL MAP
NEBRASKA

W.MERF - 7 MESSACK



LEGEND

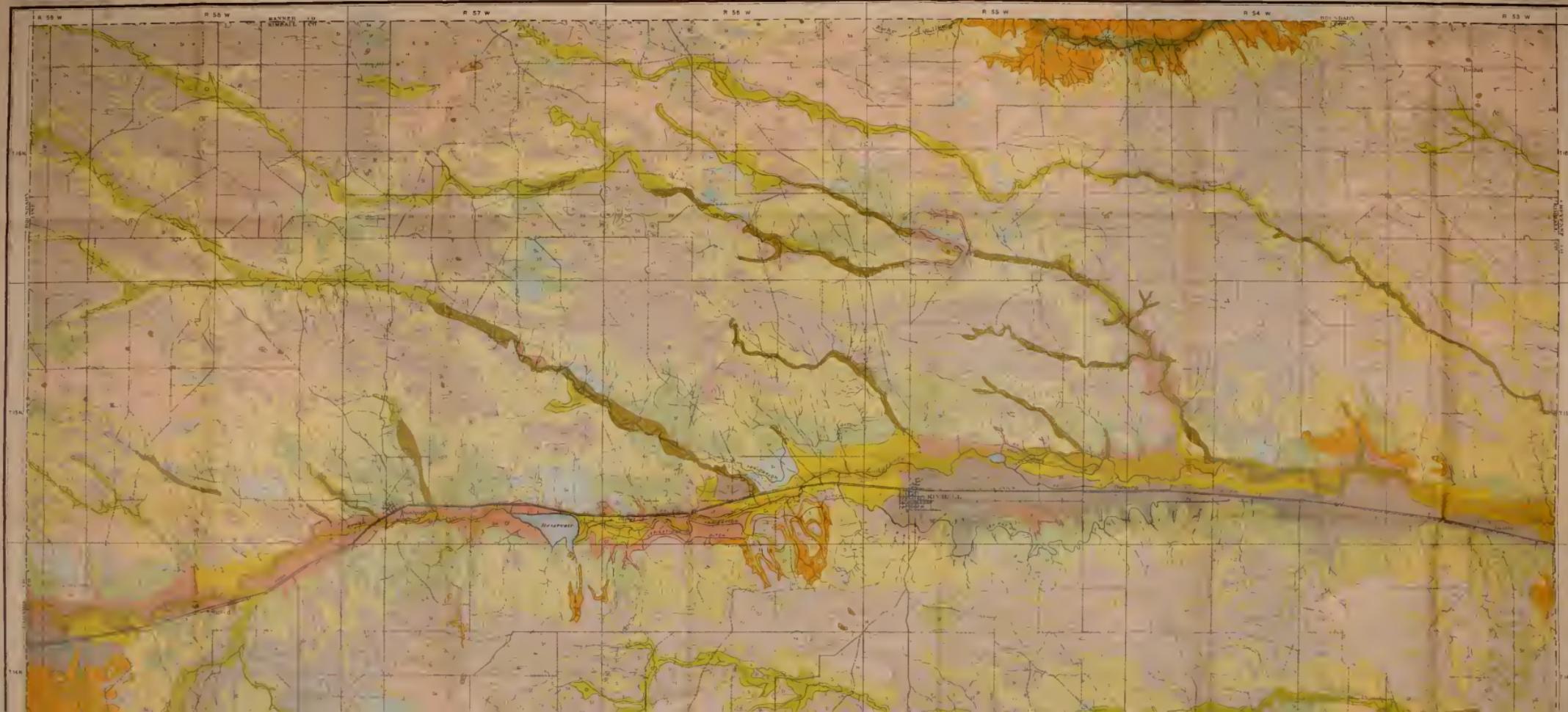
CONVENTIONAL SIGNS

1. Village at the mouth of the Tigris, probably Nineveh.	2. The Tigris, with the city of Nineveh in the distance.
3. A portion of the city of Nineveh.	4. The Tigris, with the city of Nineveh in the distance.
5. A portion of the city of Nineveh.	6. The Tigris, with the city of Nineveh in the distance.
7. A portion of the city of Nineveh.	8. The Tigris, with the city of Nineveh in the distance.
9. A portion of the city of Nineveh.	10. The Tigris, with the city of Nineveh in the distance.



SOIL MAP
NEBRA

1:100,000



LEGEND

Claypan	Calcareous Claypan
Calcareous Claypan	Calcareous Soil
Calcareous Soil	Calcareous Soil with Calcite
Calcareous Soil with Calcite	Calcareous Soil with Calcite and Gypsum
Calcareous Soil with Calcite and Gypsum	Calcareous Soil with Gypsum
Calcareous Soil with Gypsum	Calcareous Soil with Gypsum and Gypsum
Calcareous Soil with Gypsum and Gypsum	Calcareous Soil with Gypsum and Gypsum
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CONVENTIONAL SIGNS

UC SOUTHERN REGIONAL LIBRARY FACILITY



AA 001 026 512 2

[PUBLIC RESOLUTION—No. 9.]

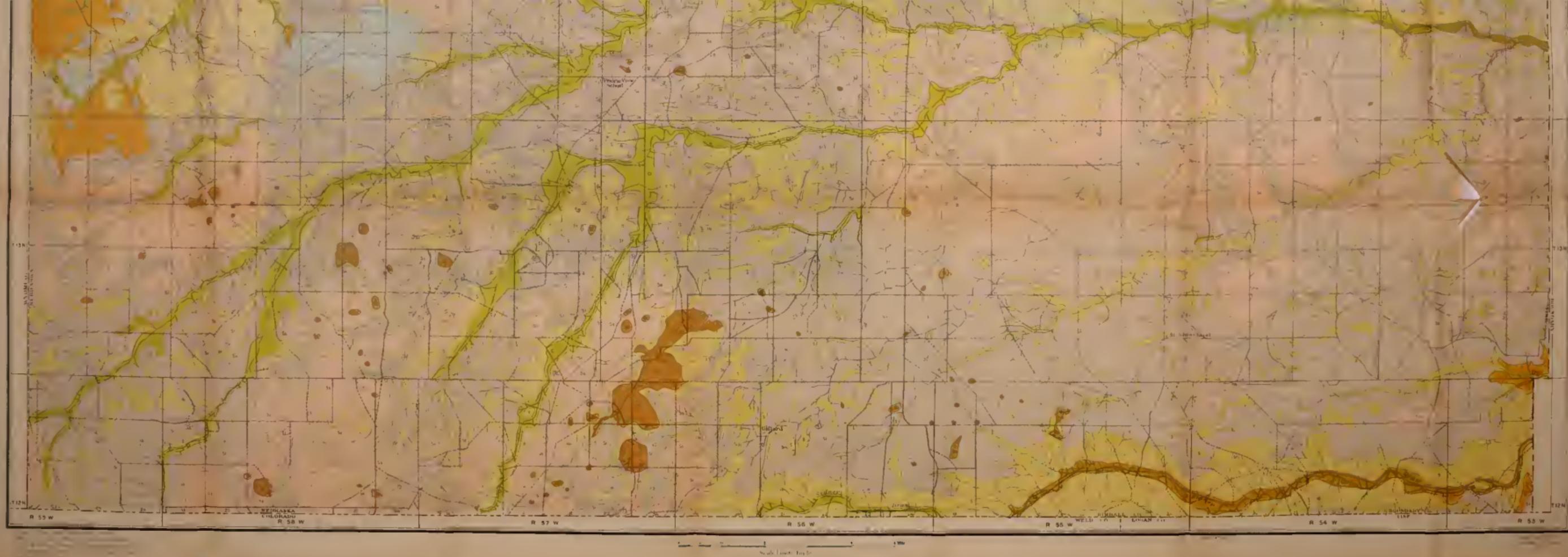
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



RIFLE COMPANY, 1ST BATTALION, 10TH INFANTRY, U.S. ARMY

Areas surveyed in Nebraska.